# PATENT COOPERATION TREATY

Translation

From the
INTERNATIONAL SEARCHING AUTHORITY

To:

# PCT

WRITTEN OPINION OF THE
INTERNATIONAL SEARCHING AUTHORITY

(PCT Rule 43*bis*.1)

| | |
|---|---|
| | Date of mailing *(day/month/year)* |
| Applicant's or agent's file reference<br>FP04-0010-00 | **FOR FURTHER ACTION**<br>See paragraph 2 below |

| International application No. | International filing date *(day/month/year)* | Priority date *(day/month/year)* |
|---|---|---|
| PCT/JP2004/004215 | 25.03.2004 | 27.03.2003 |

International Patent Classification (IPC) or both national classification and IPC

Applicant
HAMAMATSU PHOTONICS K.K.

1. This opinion contains indications relating to the following items:

| | | |
|---|---|---|
| ☒ | Box No. I | Basis of the opinion |
| ☐ | Box No. II | Priority |
| ☐ | Box No. III | Non-establishment of opinion with regard to novelty, inventive step and industrial applicability |
| ☐ | Box No. IV | Lack of unity of invention |
| ☒ | Box No. V | Reasoned statement under Rule 43*bis*.1(a)(i) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement |
| ☐ | Box No. VI | Certain documents cited |
| ☐ | Box No. VII | Certain defects in the international application |
| ☐ | Box No. VIII | Certain observations on the international application |

2. **FURTHER ACTION**

If a demand for international preliminary examination is made, this opinion will be considered to be a written opinion of the International Preliminary Examining Authority ("IPEA") except that this does not apply where the applicant chooses an Authority other than this one to be the IPEA and the chosen IPEA has notified the International Bureau under Rule 66.1*bis*(b) that written opinions of this International Searching Authority will not be so considered.

If this opinion is, as provided above, considered to be a written opinion of the IPEA, the applicant is invited to submit to the IPEA a written reply together, where appropriate, with amendments, before the expiration of 3 months from the date of mailing of Form PCT/ISA/220 or before the expiration of 22 months from the priority date, whichever expires later.

For further options, see Form PCT/ISA/220.

3. For further details, see notes to Form PCT/ISA/220.

| | |
|---|---|
| Name and mailing address of the ISA/JP<br><br>Facsimile No. | Authorized officer<br><br>Telephone No. |

WRITTEN OPINION OF THE
INTERNATIONAL SEARCHING AUTHORITY

International application No.
PCT/JP2004/004215

**Box No. I Basis of this opinion**

1. With regard to the **language**, this opinion has been established on the basis of the international application in the language in which it was filed, unless otherwise indicated under this item.

   ☐ This opinion has been established on the basis of a translation from the original language into the following language _____, which is the language of a translation furnished for the purposes of international search (under Rule 12.3 and 23.1(b)).

2. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application and necessary to the claimed invention, this opinion has been established on the basis of:

   a. type of material

      ☐ a sequence listing

      ☐ table(s) related to the sequence listing

   b. format of material

      ☐ in written format

      ☐ in computer readable form

   c. time of filing/furnishing

      ☐ contained in the international application as filed.

      ☐ filed together with the international application in computer readable form.

      ☐ furnished subsequently to this Authority for the purposes of search.

3. ☐ In addition, in the case that more than one version or copy of a sequence listing and/or table(s) relating thereto has been filed or furnished, the required statements that the information in the subsequent or additional copies is identical to that in the application as filed or does not go beyond the application as filed, as appropriate, were furnished.

4. Additional comments:

WRITTEN OPINION OF THE INTERNATIONAL SEARCHING AUTHORITY

International application No.
PCT/JP2004/004215

**Box No. V** **Reasoned statement under Rule 43bis.1(a)(i) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement**

1. Statement

| | | | |
|---|---|---|---|
| Novelty (N) | Claims | 2, 4, 8 | YES |
| | Claims | 1, 3, 5-7, 9-12 | NO |
| Inventive step (IS) | Claims | | YES |
| | Claims | 1-12 | NO |
| Industrial applicability (IA) | Claims | 1-12 | YES |
| | Claims | | NO |

2. Citations and explanations:

Document 1: JP, 2003-86826, A (HAMAMATSU PHOTONICS K.K.), 20 March 2003 (20.03.03)
Document 2: JP, 2003-86827, A (HAMAMATSU PHOTONICS K.K.), 20 March 2003 (20.03.03)
Document 3: JP, 5-121711, A (NEC CORPORATION), 18 May 1993 (18.05.93)
Document 4: JP, 11-297975, A (CANON INC.), 29 October 1999 (29.10.99)

Claims 1, 3, 5, 6

Documents 1 and 2 (Figs. 1 and 2 and their explanatory portions) describe forming photodiodes in an array form on the surface opposite the surface at which light enters an $n^-$ type semiconductor substrate, and forming a light blocking film 8 consisting of a black photoresist or light blocking metal on the surface at which light enters in a region that does not correspond to a region where photodiodes are formed. They also describe providing an $n^+$ type channel stopper layer 4 between photodiodes. In addition, they describe providing an n type accumulation layer 6 at the surface at which light enters the semiconductor substrate.

Claim 2

Document 3 (Fig. 1 and its explanatory portion) discloses technology that makes a hole 6 in the surface opposite the surface at which light enters a silicon substrate 5 and that provides a photosensitive part in the bottom of the hole 6. Employing this technology in the invention described in document 1 or document 2 could easily be achieved by a person skilled in the art.

Claim 4

Document 4 (Figs. 1 and 2 and their explanatory portions) discloses technology that discontinuously provides a light blocking film. Employing this technology in the invention described in document 1 or document 2 could easily be achieved by a person skilled in the art.

**Supplemental Box**

In case **the space in any of the preceding boxes is not sufficient.**
Continuation of Box V.2:

Claims 7, 10

Documents 1 and 2 (Figs. 1 and 2 and their explanatory portions) describe a photodiode array constitution with a step of providing a second conductivity type semiconductor layer 3 on one surface of a first conductivity type semiconductor substrate 2, and a step of providing a layer of the first conductivity type semiconductor surrounding that region, and a step of providing the light blocking layer 8 on the other surface.

Claim 8

Document 3 (Fig. 1 and its explanatory portions) discloses a step that provides a hole 6 in the surface opposite the surface at which light enters a silicon substrate 5 and a step that provides a photosensitive part in the bottom of the hole 6. Employing this technology in the invention described in document 1 or 2 could easily be achieved by a person skilled in the art.

Claim 9

Document 1 (Figs. 1 and 2 and their explanatory portions) appears to disclose a photodiode array constitution with a step of providing an n type Si accumulation layer 6 and then providing a light blocking film 8.

Claims 11, 12

Document 1 (Fig. 5 and its explanatory portions) describes providing a scintillator 17 on the surface at which light enters a semiconductor substrate.